

REMARKS

Reconsideration of this application is respectfully requested. Claims 1-18 are pending. Claim 1 has been amended to clarify the claimed method. Support for the amendment is found throughout the specification, for example, at paragraph [0003] of the published specification. No new matter has been added.

Rejections under 35 U.S.C. § 103

Claims 1-6, 10-12, and 16-18 have been rejected as obvious over U.S. Pat. No. 6,383,458 ("Brierley") in view of MacLeod, et al., *Applied and Env. Microb.*, 54(6):1365-1372 (June 1988) ("MacLeod"). The Examiner asserts that Brierley teaches a method of recovering metal from ore by adding microorganisms to a heap via drip irrigation or spraying, and that oxygen and nutrients can be injected into the heap. The Examiner concedes that Brierley does not disclose microorganisms that lack exopolymers or their reactivation. The Examiner relies on the MacLeod reference as disclosing that carbon-starved ultramicrobacteria ("UMB") that lack exopolymers (glycocalyx) are smaller and thus penetrate deeper into heap cores than do fed (vegetative) bacteria which maintain their glycocalyx exopolymer. The Examiner also contends that MacLeod discloses that nutrient stimulation of starved bacteria allows the cells to lose their dormancy and reactivate the production of exopolymers. The Examiner concludes that it would have been obvious to combine the teachings of Brierley and MacLeod to arrive at the claimed invention (*see* Office Action, pages 2-4).

Applicants traverse this rejection and respectfully request reconsideration.

For a claim to be obvious under the patent statute, the combined references must teach each and every limitation of the claimed invention and suggest their combination. Furthermore, a prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention. *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, (Fed. Cir. 1983). Therefore, the combined references alone or in combination should not teach away from the claimed invention.

MacLeod relates to the use of bacteria in the mining of oil from sandstone. Bacteria can be used to plug the sandstone formations to control the depth to which water injections sweep through the sandstone to remove oil. Specifically, MacLeod makes use of the relative difference in size between bacteria and UMB to selectively plug sandstone formations. The former have a size of about 2 to 3 microns, the latter have a size of less than 0.3 microns. Thus, UMB are about 10% the size of bacteria. According to MacLeod, it is this size differential that allows UMB to penetrate deeper into the sandstone formations than bacteria, thereby improving plugging action.

In contrast to what is disclosed in MacLeod, Applicants disclose a heap leaching process wherein bacteria are starved the point where they only lose their exopolymers, and are then reactivated so that they enhance oxidation reactions to improve heap leaching. In the present invention, the exopolymer-less bacteria are irrigated onto the heap along with nutrients which allow them to regenerate exopolymers. The bacteria adhere to rocks because of their sticky exopolymers, not because of their size. In other words, physical plugging is not involved. MacLeod does not teach or suggest reactivating the production of exopolymers on the external cells walls of the microorganisms in order to form activated microorganisms that accelerate the dissolution of minerals in a heap leaching pile by enhancing oxidation reactions. The object of MacLeod is to plug a structure, which is the opposite from the object of the claimed invention, i.e., to spread the bacteria evenly throughout the heap and then reactivate them to enhance oxidation.

Therefore, the techniques disclosed by MacLeod would not lead a person skilled in the art of heap leaching to the present claims. The skilled artisan would realize that the characteristics of the low-permeability sandstone formations are so dissimilar to those of a high permeability heap formed from crushed rock for heap leaching, that the techniques disclosed by MacLeod could not be successfully applied in heap leaching to improve oxidation reactions. A person skilled in the art also would not have predicted that MacLeod's technique would improve or result in heap leaching, but rather, would be counterproductive to heap leaching. Thus, the present invention is not obvious in view of MacLeod because MacLeod does not disclose or

suggest improved heap leaching by the activation of bacteria within a heap, wherein the activated microorganisms accelerate the dissolution of minerals by oxidation reactions. In short, MacLeod is not even applicable to the claimed invention, nor would it be recognized as such by a person of ordinary skill in the art.

Brierly also does not disclose or suggest the reactivation of bacteria to form activated microorganisms that accelerate the dissolution of minerals by oxidation reactions. Thus, the cited references, either alone or in combination, would not have led a person of ordinary skill in the art to arrive at the claimed invention. Therefore, Applicants respectfully request that this rejection be withdrawn.

Claims 7-9 and 13-15 have been rejected under 35 U.S.C. § 103(a) as obvious over Brierley in view of Macleod, and further in view of U.S. Pat. No. 6,435,769 (“Harrington”). According to the Examiner, Harrington teaches a process for treating heaps with nutrients either before or after a rock heap is formed, including the addition of slow release components.

Claim 1 has been amended to call for a method of introducing microorganisms into a heap of material for bio-assisted heap leaching, wherein activated microorganisms accelerate the dissolution of minerals by oxidation reactions. As described in the specification, microorganisms act as catalysts in the oxidation reactions that accelerate the dissolution of minerals (*see* published application, ¶3). Improved dissolution is advantageous because it improves the leaching process, i.e., improves the output of the heap.

In contrast, Harrington discloses a method of treating heaps to “prevent acid drainage” and to *displace* oxygen, thereby *reducing* oxidation reactions. Harrington states that oxygen reduction should be enough “to prevent oxidative reactions that cause acid *and soluble metal formation*” (*see* Harrington, col. 1, lines 60-67) (emphasis added). In contrast, the object of the claimed invention is to promote oxidation, solubilization, and extraction by improving oxidative reactions within a heap (*see* claim 1, step c). Although Harrington discloses methods of treating heaps, the object of Harrington (i.e., minimizing metal ionization and leaching by

reducing oxidation) is the opposite of the instant invention, i.e., *improving* oxidative reactions and solubilizing metals.

Therefore, Harrington expressly teaches away from enhancing dissolution of minerals by oxidation reactions in a heap, and as noted above, it is improper to combine references where their combination teaches away from the claimed invention (Manual of Patent Examining Procedure § 2145). A skilled artisan would not have been motivated to combine, or have a reasonable expectation of success in combining, the teachings of all three references to arrive at the present invention because Harrington discloses decreasing oxidation in a heap, whereas the claimed invention augments oxidation and hence dissolution. Finally, in view of Harrington, a person of ordinary skill in the art would not predict that reducing oxidative reactions within a heap, as disclosed in Harrington, would lead to assisted heap leaching, as presently claimed. *See KSR v. Teleflex*, 550 U.S. ____ (2007) (a combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results).

For the foregoing reasons, the invention called for in the present claims is not obvious in view of the cited references. Applicants respectfully request that this rejection be withdrawn, accordingly.

CONCLUSION

In view of the above amendments and remarks, it is respectfully requested that the application be reconsidered and that all pending claims be allowed and the case passed to issue.

If there are any other issues remaining that the Examiner believes can be resolved through either a Supplemental Response or an Examiner's Amendment, the Examiner is respectfully requested to contact the undersigned at the telephone number indicated below.

Dated: October 26, 2007

Respectfully submitted,

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